

Spectral Evidence for Appearance of New Decretion Disk Around IGR J06074+2205

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We report about new episode of decetion disk formation in the IGR J06074+2205 system. Obtained spectral data gives us opportunity to measure peak separation in double-peaked H_α line as 408 ± 55 km/s and hence obtain disk radii as 1.6 star radii. All these facts may says about possible X-ray activity of IGR J06074+2205 in the nearest future.

1 Introduction

IGR J06074+2205 is a NS Be/X-ray binary of B0.5V spectral type. The distance to the object is about 4.5 kpc. From investigation of three HeI lines the rotational velocity of the star was determined as 260 ± 20 km/s. And after the five years of the spectral monitoring of IGR J06074+2205 (P.Reig et al., 2010) it was reported about the fact of reversion from emission to absorption of the H_α line and hence disappearance of the equatorial disk. The total disk disappearance was observed in March 2010 when H_α line profile fully have gone into absorption.

In general, disk appearance and disappearance episodes are usual for Be/X-ray binaries but disk loss episodes are more observed. Now it is known that decetion disks in these systems exists about of 3-7 years (see Table 5, P.Reig, 2011) and typical disk loss episodes lasted about 1.5-2 years. Due to absence of significant amount of information about disk producing and growing up episodes we put the aim to study disks in the phase of its formation and IGR J06074+2205 can be the first candidate for this study.

2 Observations and Data Reduction

IGR J06074+2205 was observed April 14 and April 24, 2012 at International Center for Astronomical, Medical and Ecological Research with the 2m Ritchey-Chretien-Coude telescope with Cassegrain Multi Mode Spectrograph (CMMS) (with $R = 14000$) as a part of spectral monitoring of the selected Be/X-ray binaries. We have obtained one spectra per night with 2700^s exposure (A.Simon et al., 2012) for the object. Calibration frames were taken the same nights. For our analysis we have used only one order with H_α line from the whole echelle spectrum. The SNR value in the H_α region is 10.

All data were proceed with Dech95 software (G.A. Galazutdinov). Due to such low SNR value it was impossible to use bias and dark frames for calibration due to presence of negative pixel's intensities in the resulting frame. So we decide to subtract from the selected echelle order the noise measured both sides of this order. The subtracted spectral orders were analyzed with Dech20Tsoftware (G.A. Galazutdinov). To make a dispersion curve we have used both Fe-Ar lamp specter and day sky specter. With the help of dispersion curve we have determine the spectral dispersion as 0.25 \AA/px .

3 Data Analysis and Results

Using our spectrum of IGR J06074+2205 obtained April 14 (black line on Fig.1) and April 24 (red line on Fig.1) we can clearly identify double peak H_α emission line and its V/R variability. Appearance of H_α emission line may indicate about appearance of the equatorial disk around Be star. In spite of high level noise spectra it is possible to conclude that symmetric H_α line has a shell profile with $\text{FWHM}=12.4\pm0.5\text{\AA}$. Peaks separations for this line is $408\pm55\text{ km/s}$. Taking into account the star's rotational velocity $260\pm20\text{ km/s}$ (P.Reig et al., 2010) and correlation between star's and disc radii one can obtain the disk radii of about 1.6 star radii.

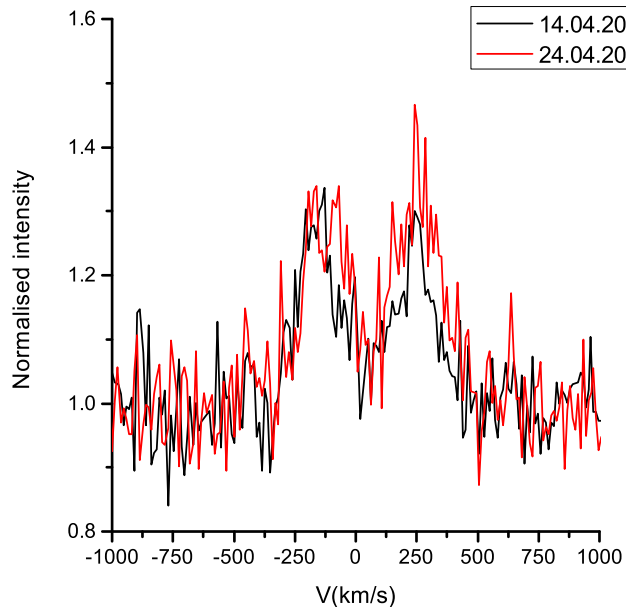


Figure 1. Two samples of H_α line profiles obtained 2012 April, 14 - black and April, 24 - red

4 Discussion

The timescale between full disk disappearance (H_α in absorption) and its next appearance (H_α in emission again) for the case of IGR J06074+2205 is no more than 26 months (or about 2 years). This timescale may be smaller due to absence of observations during this two years. For example, in some other objects the time between observed last absorption and first emission in H_α are believed to be about some months. In the case of A0535+26 (see Fig.2, N.J. Haigh et al., 1999) such timescale is about 3 month. For V635 Cas (I. Negueruela et al., 2001) it was obtained only 2 spectra with the time interval of 4 months which shows changes from absorption to emission. But there are some other systems, such as X Per (J.S. Clark et al., 2001) and RX J0440.9+4431 (P.Reig et al., 2005), which didn't show any absorption lines during disk loss episodes. Their H_α profiles were mostly flat like continuum (X Per) or very weak emission ($\text{EW}\leq 1$).

Disk appearance and its small size (1.6 star radii) gives us opportunity to predict a new episode of optical and possible X-ray activity of IGR J06074+2205 in the nearest future with its V/R variability and increasing of IR excess. Further spectral and photometrical observations in the optical and IR bands are encouraged and useful for understanding disk formation mechanisms.

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